

Amendments to the Claims

This listing of claims will replace all prior listings of claims in the application.

Listing of Claims

1. (Currently Amended) A tiling method for culling small objects in a system for shading 3-dimensional computer graphics images, comprising the steps of:

subdividing a display on which an image is to be viewed into a plurality of rectangular areas;

deriving a list of objects in the image which may be visible in ~~that~~each of the rectangular ~~area~~areas;

determining maximum and minimum values for ~~an object~~each object in the list in x and y directions;

determining a minimum set of sampling points ~~from~~for the object from the maximum and the minimum values;

surrounding the object with a bounding box;

determining if the bounding box covers any of the sampling points;

culling the object if the bounding box misses all of the sampling points;

testing each of the sampling ~~point~~points in the minimum set against each edge of the object if the bounding box does not miss all of the sampling points; and

culling the object in the system for shading 3-dimensional computer graphics if the object does not cover any of the sampling points.

2. (Currently Amended) ~~A~~The method according to claim 1 further including the ~~step~~steps of determining whether or not ~~the~~ separation of the sampling points in the x and the y directions exceeds ~~the~~a resolution of the display+, and adding or rejecting the object from the list ~~independen~~based on ~~the~~a result of the determination.

3. (Currently Amended) ~~A~~The method according to claim 2
~~in which, wherein~~ the resolution of the display comprises ~~the~~
pixel separation of the display.

4. (Canceled)

5. (Currently Amended) The method according to claim 1
further including the step of, for each ~~object~~of the objects,
selecting only those rectangular areas which fall at least
partially within the ~~object's~~ bounding box of the object when
determining whether or not that object is to be added to the
list for ~~a~~the rectangular area.

6. (Currently Amended) A tiling method for shading
3-dimensional computer graphics images in a system for shading
3-dimensional computer graphics images comprising the steps
of:

subdividing a display for ~~an image~~each of the images into
a plurality of rectangular areas;

for each object in the image, determining a bounding box
of the rectangular areas into which the object may fall;

testing an edge information from each object against a
consistent sample point in each of the rectangular ~~area~~areas
to determine whether or not the object falls into each of the
rectangular areas in the bounding box; and

inserting the object in an object list for ~~a~~the
rectangular area in dependencebased on ~~the~~a result of the
determination,

wherein the step of testing the edge information includes
the step of shifting the edge information by a predetermined
amount in dependencebased on ~~the~~an orientation of each edge.

7. (Currently Amended) ~~A~~The method according to claim 6
~~in which, wherein~~ the step of shifting the edge information

comprises the step of shifting by either the vertical or a horizontal dimension of athe rectangular area.

8. (Currently Amended) AThe method according to claim 7 in which, wherein the shifting step is performed using a floating point calculation.

9. (Currently Amended) AThe method according to claim 6 in which, wherein the shifting step is performed with a safety margin whereby ~~object~~the object will be included in the object ~~list~~list for athe rectangular area if the edge information falls close to athe sampling point.

10. (Currently Amended) AnA tiling apparatus for culling small objects in a system for shading 3-dimensional computer graphics images, comprising:

means for subdividing a display on which ~~an image~~each of the images is to be viewed into a plurality of rectangular areas;

means for deriving a list of objects in the image which may be visible in each of the rectangular ~~area~~areas;

means for determining maximum and minimum values for ~~object~~each object in the list in x and y directions;

means for determining a minimum set of sampling points for the object from the maximum and the minimum values;

means for surrounding the object with a bounding box;

means for determining if the bounding box covers any of the sampling points;

means for culling the object if the bounding box misses all of the sampling points;

means for testing each of the sampling ~~point~~points in the minimum set against each edge of the object if the bounding box does not miss all of the sampling points; and

means for culling the object if the object does not cover any of the sampling points.

11. (Currently Amended) The apparatus according to claim 10 further including means for determining whether or not ~~the~~ separation of the sampling points in the ~~X and Yx and the y~~ directions exceeds ~~thea~~ resolution of the display+, and means for adding or rejecting the object from the list ~~in dependencebased~~ on ~~thea~~ result of the determination.

12. (Currently Amended) ApparatusThe apparatus according to claim 11 ~~in which, wherein~~ the resolution of the display comprises ~~thea~~ pixel separation of the display.

13. (Canceled)

14. (Currently Amended) The apparatus according to claim 10 further including means for selecting for each object only those rectangular areas which fall at least partially within the bounding box of the object when determining whether or not that object is to be added to the list for ~~a~~the rectangular area.

15. (Currently Amended) ApparatusA tiling apparatus for shading a three-dimensional computer graphics image comprising:

means for subdividing a display for ~~an~~the image into a plurality of rectangular areas;

means for determining for each object in the image a bounding box of the rectangular areas into which the object may fall;

means for testing an edge information ~~from~~for each object against a consistent sample point in each of the rectangular ~~areaareas~~ to determine whether or not the object falls into each ~~of thea~~ rectangular ~~areasarea~~ in the bounding box; and

means for inserting the object in an object list for ~~a~~the rectangular area ~~in dependencebased~~ on ~~thea~~ result of the determination+,

wherein the means for testing the edge information includes means for shifting the edge information by a predetermined amount in dependence based on the orientation of each edge.

16. (Currently Amended) AnThe apparatus according to claim 15 in which, wherein the means for shifting the edge information comprises means for shifting by either the vertical or a horizontal dimension of atthe rectangular area.

17. (Currently Amended) AnThe apparatus according to claim 16 in which, wherein the shifting means uses a floating point calculation.

18. (Currently Amended) ApparatusThe apparatus according to claim 15 in which, wherein the shifting means uses a safety margin whereby objectsthe object will be included in the object listlist for atthe rectangular area if the edge information falls close to atthe sampling point.

19. (Currently Amended) The method according to claim 1 further including the step of determining whether or not the minimum set of the sampling points are spread by more than 1 x 1 pixel and not 2 x 2 pixels, in the x and the y directions, wherein the step of testing the object for cullingsampling points is not performed if the sampling points exceed this limit.

20. (Currently Amended) The apparatus according to claim 10 further including means for determining whether or not the minimum set of the sampling points are spread by more than 1 x 12 x 2 pixel in the x and the y directions, and not testing the object for culling, wherein the means for testing the sampling points do not perform testing if the sampling points exceed this limit.

21. (New) A tiling method for culling small objects in a system for shading 3-dimensional computer graphics images, comprising the steps of:

 deriving a list of the objects in the image which may be visible;

 determining maximum and minimum values for each of the objects in the list in x and y directions;

 determining a minimum set of sampling points for the object from the maximum and the minimum values;

 surrounding the object with a bounding box;

 determining if the bounding box covers any of the sampling points;

 culling the object if the bounding box misses all of the sampling points;

 testing each of the sampling points in the minimum set against each edge of the object if the bounding box does not miss all of the sampling points; and

 culling the object in the system for shading 3-dimensional computer graphics images if the object does not cover any of the sampling points.

22. (New) The method according to claim 21 further including the steps of determining whether or not separation of the sampling points in the x and the y directions exceeds a resolution of the display, and adding or rejecting the object from the list based on a result of the determination.

23. (New) The method according to claim 22, wherein the resolution of the display comprises a pixel separation of the display.

24. (New) A tiling apparatus for culling small objects in a system for shading 3-dimensional computer graphics images, comprising:

 means for deriving a list of the objects in the image which may be visible;

means for determining maximum and minimum values for each of the objects in the list in x and y directions;

means for determining a minimum set of sampling points for the object from the maximum and the minimum values;

means for surrounding the object with a bounding box;

means for determining if the bounding box covers any of the sampling points;

means for culling the object if the bounding box misses all of the sampling points;

means for testing each of the sampling points in the minimum set against each edge of the object if the bounding box does not miss all of the sampling points; and

means for culling the object if the object does not cover any of the sampling points.

25. (New) The apparatus according to claim 24 further including means for determining whether or not separation of the sampling points in the X and the Y directions exceeds a resolution of the display, and means for adding or rejecting the object from the list based on a result of the determination.

26. (New) The apparatus according to claim 25, wherein the resolution of the display comprises a pixel separation of the display.

27. (New) The method according to claim 21 further including the step of determining whether or not the minimum set of the sampling points are spread by more than 2 x 2 pixels in the x and the y directions, wherein the step of testing the sampling points is not performed if the sampling points exceed this limit.

28. (New) The apparatus according to claim 24 further including means for determining whether or not the minimum set of the sampling points are spread by more than 2 x 2 pixels in

the x and the y directions, wherein the means for testing the sampling points do not perform testing if the sampling points exceed this limit.